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Indian Standard

SPECIFICATION FOR COTTON WEBBING FOR PARACHUTES

(Second Revision)

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
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Indian Standard

SPECIFICATION FOR COTTON WEBBING FOR PARACHUTES

(Second Revision)

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Indian Standard

SPECIFICATION FOR COTTON WEBBING FOR PARACHUTES

(Second Revision)

0. FOREWORD

0.1 This Indian Standard (Second Revision) was adopted by the Indian Standards Institution on 15 October 1984, after the draft finalized by the Textile Materials for Aerospace Purposes Sectional Committee had been approved by the Textile Division Council.

0.2 This standard was originally published in 1966 and was revised in 1979 to take care of the modifications recommended by the Air Delivery Research & Development Establishment, Agra; and the Chief Inspectorate of Textiles & Clothing, Kanpur. It has again been revised in the light of the experience gained during its use.

0.3 Considerable assistance has been derived from BS 4F 49 : 1984 'Specification for cotton webbing for aerospace purposes', issued by the British Standards Institution.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies the requirements for two types of cotton webbing one of width 38 mm and the other of width 75 mm used mainly in the fabrication of man-dropping parachutes.

---

*Rules for rounding off numerical values (*revised*).

2. YARN

2.1 The webbing shall be manufactured from unsized cotton yarns of nominal counts as follows:

a) Warp — 3 ply yarn of resultant count 150 tex, and

b) Weft — 3 ply yarn of resultant count 90 tex.

3. MANUFACTURE

3.1 The weave shall be 2/2 V twill.

4. FINISH

4.1 Condition of Material — The webbing shall be supplied in one of the following conditions:

a) Loomstate;

b) Scoured and rot-proofed; and

c) Scoured, dyed and rot-proofed.

4.2 Dyeing — If dyeing is required, the colour shall be as stated in the contract or order and either the webbing or the yarns from which it is to be manufactured shall be dyed. Sulphur dyes shall not be used. The rot proofing treatment by LPCP or PCPL as stated in **4.3** may be given subsequently.

4.3 Rot-Proofing — If rot-proofing is required, the webbing or the yarns from which it is to be manufactured shall be evenly and thoroughly impregnated with a solvent solution or acqueous emulsion of lauryl pentachlorophenol (LPCP) or of pentachlorophenyl laurate (PCPL). This shall be followed by removal of the excess and subsequent drying or thorough solvent removal. The treated textile shall be dry in handling and non-tacky. The LPCP or PCPL content of the treated textile when tested according to the methods prescribed in IS : 3522 (Part 2)-1970* or Appendix A shall not be less than 1·7 percent and not more than 2·5 percent on the oven dry mass of the textile material. The free pentachlorophenol content of the treated textile shall not exceed 10 percent of the LPCP or PCPL content (*see* Note under **A-3**).

4.4 Freedom from Defects — In case of webbing to be used for personnel parachutes, each roll shall be visually examined metre by metre for the defects as given in Appendix B. The roll shall be acceptable only if it is free from these defects.

---

*Method for estimation of common preservatives used in textile industry, Part 2.

5. REQUIREMENTS

5.1 The types 1 and 2 webbings shall meet the physical and chemical requirements as given in Tables 1 and 2.

TABLE 1 PHYSICAL REQUIREMENTS OF COTTON WEBBING FOR PARACHUTES

TYPE	LENGTH OF ROLL, *Min*	WIDTH	ENDS IN FULL WIDTH	PICKS PER cm	MASS, *Max*	BREAKING LOAD, WARPWAY (20 cm × FULL WIDTH), *Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	m	mm			g/m	N
i)	100 or as ordered	$38\,{}^{+1\cdot5}_{-0}$	$112\,{}^{+4}_{-0}$	12 ± 1	27	1 815
ii)	100 or as ordered	$75\,{}^{+1\cdot5}_{-0}$	$222\,{}^{+4}_{-0}$	12 ± 1	50	3 675
Methods of Tests	Appendix C	Appendix D	IS : 1963-1981*		Appendix E	IS : 1969-1968†

*Method for determination of threads per unit length in woven fabrics (*second revision*).

†Methods for determination of breaking load and elongation at break of woven textile fabrics (*first revision*).

TABLE 2 CHEMICAL REQUIREMENTS OF COTTON WEBBING FOR PARACHUTES

SL No.	CHARACTERISTIC	REQUIREMENTS FOR TYPES 1 AND 2	METHOD OF TEST
(1)	(2)	(3)	(4)
i)	Colour fastness to:		
	a) Light	5 or better	IS : 686-1957* or IS : 2454-1967†
	b) Washing (change in colour)	5	IS : 764-1979‡
ii)	Scouring loss, percent, *Max*	3	IS : 1383-1977§ (Severe method)
iii)	Water soluble matter, percent, *Max*	1	IS : 3456-1966‖

*Method for determination of colour fastness of textile material to daylight.

†Method for determination of colour fastness of textile materials to artificial light (xenon lamp).

‡Method for determination of colour fastness of textile materials to washing: Test 3 (*second revision*).

§Method for determination of scouring loss in grey and finished cotton textile materials (*first revision*).

‖Method for determination of water soluble matter of textile materials.

6. MARKING

6.1 Each roll shall carry the following information:

a) Name and width (mm) of material,

b) Length/roll (m),

c) Month and year of manufacture, and

d) Name of the manufacturer/trade-mark.

6.1.1 Each roll may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

7. PACKING

7.1 Webbing rolls, individually wrapped in polyethylene (*see* IS : 2508-1977*) or water proof paper (*see* IS : 1398-1968†), shall be tightly packed in heavy cee jute cloth (*see* IS : 3751-1966‡) to form a bale not exceeding 50 kg in gross mass.

7.2 Each bale shall be marked with the details of the consignment as provided in the contract or order in addition to the marking given in **6.1.**

8. SAMPLING

8.1 Lot — All the rolls of webbing purporting to be of one definite type and quality delivered to one buyer against one despatch note shall constitute a lot.

8.2 The conformity of the lot to the requirements of this standard shall be determined on the basis of tests carried out on the samples selected from the lot.

---

*Specification for low density polyethylene films (*first revision*).

†Specification for packing paper, waterproof, bitumen-laminated (*first revision*).

‡Specification for heavy cee cloth.

8.3 Unless otherwise agreed to between the buyer and the seller, the number of rolls to be selected at random from a lot shall be in accordance with col 2 of Table 3.

TABLE 3 SAMPLE SIZE AND CRITERIA FOR CONFORMITY

LOT SIZE (NUMBER OF ROLLS) (1)	SAMPLE SIZE (NUMBER OF ROLLS TO BE SELECTED) (2)	PERMISSIBLE NUMBER OF NON-CONFORMING ROLLS (3)	SUB-SAMPLE SIZE (NUMBER OF ROLLS TO BE SELECTED) (4)
Up to 100	10	1	5
101 to 300	15	1	6
301 to 500	25	2	7
501 to 800	35	3	8
801 to 1 300	50	4	9
1 301 and above	75	6	10

8.4 For evaluating (a) ends in full width and picks per cm, (b) width, and (c) length, the rolls selected as in col 2 of Table 3 shall constitute the test sample.

8.5 For evaluating (a) mass, (b) breaking load, (c) water soluble matter, (d) scouring loss, and (e) colour fastness, the number of rolls specified in col 4 of Table 3 shall constitute the test sample. These rolls shall be selected at random from those selected in col 2 of Table 3. The required number of test specimens shall be drawn from each roll and subjected to corresponding tests.

NOTE — In the case of breaking load tests, at least 10 representative test specimens shall be drawn from each roll for the purpose of tests.

8.6 Criteria for Conformity — The lot shall be considered to be in conformity with the requirements of this standard if the following conditions are satisfied;

a) The number of rolls found non-conforming with respect to [(i) ends in full width and picks per cm, and (ii) width does not exceed the corresponding number given in col 3 of Table 3.

b) In the case of length, the value obtained for each roll shall be compared with its declared or marked length. The mean percentage of deficiency in length, if any, shall be determined and made applicable to the lot.

c) From the observed values of mass, the average $\bar{X}$ and the range R shall be calculated and the value of the expression $\bar{X} + 0{\cdot}6\ R$ shall be less than or equal to the specified value.

d) From the observed values of breaking load tests in respect of each roll in the test sample, the average breaking load value shall be calculated. From all such average breaking load values the grand average $\bar{X}$ and the range R shall be calculated and the value of the expression $\bar{X} - 0{\cdot}6\ R$ shall be greater than or equal to the specified value.

NOTE 1 — The average breaking load value for a roll is the value obtained by dividing the sum of the observed values in respect of the test specimens taken from the roll by the number of test specimens. Grand average $\bar{X}$ is the value obtained by dividing the sum of the average breaking load values in respect of the rolls in the test sample by the number of rolls tested.

NOTE 2 — Range R is the difference between the maximum and the minimum in a set of average breaking load values for the rolls tested.

e) From the observed values of water soluble matter, the average $\bar{X}$ and the range R shall be calculated and the value of the expression $\bar{X} + 0{\cdot}6\ R$ shall be less than or equal to the specified value.

f) From the observed values of scouring loss, the average $\bar{X}$ and the range R shall be calculated and the value of the expression $\bar{X} + 0{\cdot}6\ R$ shall be less than or equal to the specified value.

NOTE 1 — Average $\bar{X}$ is the value obtained by dividing the sum of the observed values by the number of tests.

NOTE 2 — Range R is the difference between the maximum and the minimum in a set of observed values.

g) The colour fastness ratings obtained on tests satisfy the corresponding requirements.

h) In case of webbing used for personnel parachutes, each roll shall be visually examined metre by metre for the defects given in Appendix B and it shall be acceptable only if it is free from these defects.

APPENDIX A

(*Clause* 4.3)

DETERMINATION OF PENTACHLOROPENYL LAURATE (PCPL) CONTENT

A-1. General — The method is applicable to the determination of PCPL in the absence of added pentachlorphenol. The proofing is hydrolyzed, acidified and steam distilled and the pentachlorophenol in the distillate extracted with 1, 1, 1-trichloroethane and complexed with copper sulphate-pyridine reagent. The optical density of the complex in 1, 1, 1-trichloroethane is measured on a suitable sepctrophotometer at 450 nm.

A-2. Reagents

A-2.1 Ethanediol (ethylene glycol).

A-2.2 1, 1, 1-trichloroethane.

A-2.3 Pridine (AR, GPR grade).

A-2.4 Sodium hydroxide, pellet.

A-2.5 Copper sulphate reagent solution 50 g/l.

A-2.6 Pentachlorophenol (standard reagent), melting point 180°C minimum.

A-2.7 Hydrochloric acid, concentrated 36 percent (*m*/*v*) (11 M).

A-2.8 Copper Sulphate — pyridine reagent prepared by mixing 4 ml pyridine with 6 ml copper sulphate solution immediately before use.

A-3. Procedure — Weigh 2·5 ± 0·05 g of the material, cut into small pieces of not more than 5 mm square and place in a dry 250 ml round flask (B 24/29 socket). Add 30 ml of ethanediol, 4 g of sodium hydroxide (pellet form), 2 to 4 ml of water in, that order and a few anti bumping granules. Connect the flask with a double surface condenser, bring the contents to boiling point on a sand bath and boil them vigorously for 30 minutes under reflux. After this allow the contents of the flask to cool, remove the reflux condenser and add through a funnel 60 ml water followed by 20 ml hydrochloric acid. Steam distill the contents of the flask ensuring that a constant volume is maintained by applying gentle heat as necessary. Collect 300 ml of distillate in a suitable receiver, applying care to prevent loss of pentachlorophenol in the distillate by adequate cooling. Discontinue the external heating of the flask a few minutes before disconnecting the steam supply. Disconnect the condenser and fit it vertically over the distillate receiver. Wash down the condenser with 25 ml to 30 ml of trichloroethane and collect the washing in the distillate. Transfer the distillate and trichloroethane washings to a 500 ml separating funnel and shake thoroughly. Allow the layers of water and trichloroethane to separate completely before running off the trichloroethane layer into a 100 ml separating funnel. Wash the condenser and distillate receiver with a further 25 to 30 ml trichloroethane and add this to the aqueous solution into the 500 ml separating funnel. Repeat the extraction as given above and add the trichloroethane layer to the first trichloroethane extract in the 100 ml separating funnel. Add to the bulked trichloroethane extract 10 ml of copper sulphate-pyridene reagent and shake well. After complete separation of the aqueous and trichloroethane layers, run the lower trichloroethane layer into a 100 ml volumetric flask via a small funnel containing anhydrous sodium sulphate supported by means of a quartz wool plug. Add a small quantity of trichloroethane to the copper sulphate-pyridine solution remaining in the separating funnel, shake and allow the layers to separate. Filter the trichloroethane layer through quartz wool plug and collect in the volumetric flask. Wash the filter with further small quantities of trichloroethane and finally make up to 100 ml tricholoroethane.

Determine the optical density of the solution using a suitable spectrophotometer at 450 nm using trichloroethane as a blank. Estimate the PCPL content by reference to a calibration graph prepared from known standards of pentachlorophenol (1·0 percent pentachlorophenol = 1·71 percent PCPL).

NOTE — If the proofing is expected to contain both pentachlorophenol and PCPL then the free pentachlorophenol content should be determined as given in IS : 3522 (Part 1)-1966* and the amount found deducted from the apparent PCPL content.

A-4. CALIBRATION

A-4.1 Direct — Prepare a calibration graph using 5, 10, 15 ml aliquots of a standard solution of pentachlorophenol reagent (1 g/200 ml) in trichloroethane to cover a range of 1, 2 and 3 percent respectively. Dilute each aliquot to 50-60 ml with trichloroethane, add 10 ml of copper sulphate-pyridine reagent, shake well and then follow the described procedure. Plot optical density against concentration of PCPL.

A-4.2 Indirect — Prepare a calibration graph using 5, 10, 15 ml aliquots of a standard solution of pentachlorophenol reagent (1 g/200 ml) in dilute sodium hydroxide solution (sufficient for complete solution of pentachlorophenol). Place each aliquot in a round bottomed flask, add 60 ml water and 20 ml hydrochloric acid. Fit the flask for steam distillation and then follow the described procedure.

If the distillation technique is satisfactory then the graphs obtained as in **A-4.1** and **A-4.2** should be the same.

---

*Method for estimation of common preservatives used in the textile industry, Part 1.

APPENDIX B

[*Clauses* 4.4 *and* 8.6(*h*)]

CLASSIFICATION OF MAJOR DEFECTS

B-1. Width Deviation — Any part outside the limits specified in this standard.

B-2. Warp Bow — Any part in which the warp bow when measured on a 1 m length exceeds 10 mm.

B-3. Slack or Unevenly Woven Selvedges — Any part that does not lie flat and even or shows a distinct 'saw tooth' effect.

B-4. Cut, Broken or Missing Threads — Two or more in warp or weft regardless of length.

B-5. Knots in Warp Ends or Weft Picks — One or more.

B-6. Floats — Any float affecting more than two ends and extending more than 6·5 mm.

B-7. Pick Variation — Variation outside the tolerances specified in this standard other than slight local variation.

B-8. Mechanical Damage, Abrasion Marks — Any damage affecting the breaking load.

B-9. Inclusions — Any hard or soft foreign bodies which cause appreciable added thickness.

B-10. Cut, Hole or Tear — Three or more warp or weft threads ruptured at adjoining points.

B-11. Loop, Kinks, Snarls (Except Selvedges) — All over 3 mm in length.

B-12. Selvedge, Cut, Broken, Torn, Scalloped — Any cut, broken, torn or scalloped selvedge.

B-13. Spot, Stain or Streaks — (a) Single ends or picks 40 cm or more in length, and (b) Double ends or picks 20 cm or more in length.

APPENDIX C

(*Table* 1)

METHOD FOR DETERMINATION OF LENGTH OF ROLL

C-1. TEST SPECIMENS

C-1.1 For the purpose of this test, all the rolls in the test sample (*see* **8.4**) shall constitute the test specimens.

C-2. EQUIPMENT

C-2.1 A flat table, little over 5 m long, having a smooth horizontal surface with markings in metres and centimetres on one side, shall be used.

C-3. PROCEDURE

C-3.1 Unroll one test specimen, draw one of its ends across the full length of the table and smoothen the portion of the webbing on the table with no greater tension than is necessary to make it lie straight and flat.

C-3.2 Mark on the webbing the first 5 m length as measured against the mark on the table. Measure the entire length, correct to a centimetre against the markings on the table.

C-3.3 Compare the value obtained in **C-3.2** with the declared or marked length of the roll and note the deficiency in length, if any.

C-3.4 Repeat the test with the remaining test specimens and calculate the mean percentage deficiency in length, if any.

APPENDIX D

(*Table* 1)

METHOD FOR DETERMINATION OF WIDTH OF THE WEBBING

D-1. TEST SPECIMENS

D-1.1 For the purpose of this test, all the rolls in the test sample (*see* **8.4**) shall constitute the test specimens.

D-2. PROCEDURE

D-2.1 Unroll one test specimen and lay a portion of it on a horizontal surface and smoothen it out with no greater tension than is necessary to make it lie straight and flat.

D-2.2 Measure to an accuracy of 1 mm the width of the webbing by means of a graduated steel scale placed at right angles to the selvedges.

D-2.3 Determine similarly the width of the webbing at 5 different places uniformly distributed along the length of the roll. Calculate the mean of the 5 test values.

D-2.4 Repeat the test with the remaining test specimens.

D-3. REPORT

D-3.1 Report the lot to be in conformity with the relevant requirements of Table 1 if the number of rolls whose width varies by more than the tolerance prescribed in the Table 1 is not more than the corresponding number given in col 3 of Table 3.

APPENDIX E

(*Table* 1)

METHOD FOR DETERMINATION OF MASS

E-1. TEST SPECIMENS

E-1.1 Cut a piece of webbing approximately 4 m in length from each of the rolls constituting sample under test (*see* **8.5**).

E-2. CONDITIONING OF TEST SPECIMENS

E-2.1 Prior to test, the test specimens shall be conditioned in a standard atmosphere at 65 ± 2 percent relative humidity and 27 ± 2°C temperature (*see* IS : 196-1966*) for 48 hours.

E-3. PROCEDURE

E-3.1 Take a test specimen and apply a tension equal to one percent of the minimum specified breaking load of the webbing (*see* Note). After 60 ± 5 seconds, place two marks on the webbing 3 m apart.

---

*Atmospheric conditions for testing (*revised*).

Note — The tension may be applied in a breaking load testing machine. It may also be applied by fixing one end of the webbing to a peg, passing the webbing around a pulley and hanging the desired load at the other end.

E-3.2 Release the load and cut the test specimen at the marks and then determine its mass to the nearest 0·1 g.

E-3.3 Calculate the mass of the webbing by the following formula:

$$W = \frac{W_1}{3}$$

where

W = mass, the webbing (g/m); and

W_1 = mass (g) of 3 m length of the webbing (*see* **E-3.2**).

E-3.4 Repeat the test with the remaining test specimens (*see* **E-1.1**).

E-4. REPORT

E-4.1 Report the lot to be in conformity with the relevant requirements of Table 1 if the condition prescribed in **8.6**(c) is satisfied.

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(*Page* 5, *Table* 1, *col* 3) — Substitute ± 1.5 for tolerance on width mentioned as $^{+1.5}_{-0}$ against both types (i) and (ii).

(TX 13)

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